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Fracking Can Contaminate Drinking Water

It took nearly a decade, but former EPA scientist Dominic DiGiulio has proved that fracking has polluted groundwater in Wyoming

By Gayathri Vaidyanathan, ClimateWire on April 4, 2016

Education Images / Contributor via Getty Images

Former EPA scientist Dominic DiGiulio never gave up.

Eight years ago, people in Pavillion, Wyo., living in the middle of a natural gas basin, complained of a bad taste and smell in their drinking water. U.S. EPA launched an inquiry,

helmed by DiGiulio, and preliminary testing suggested that the groundwater contained toxic chemicals.

Then, in 2013, the agency suddenly transferred the investigation to state regulators without publishing a final report.

Now, DiGiulio has done it for them.

He published a comprehensive, peer-reviewed study last week in Environmental Science and Technology that suggests that people's water wells in Pavillion were contaminated with fracking wastes that are typically stored in unlined pits dug into the ground.

The study also suggests that the entire groundwater resource in the Wind River Basin is contaminated with chemicals linked to hydraulic fracturing, or fracking.

This production technique, which involves cracking shale rock deep underground to extract oil and gas, is popular in the United States. It's also controversial. There are thousands of wells across the American West and in California that are vulnerable to the kind of threat documented in the study, DiGiulio said. He is now a research scholar at Stanford University.

"We showed that groundwater contamination occurred as a result of hydraulic fracturing," DiGiulio said in an interview. "It contaminated the Wind River formation."

The findings underscore the tension at the heart of the Obama administration's climate change policy, which is based on replacing many coal-fired power plants with facilities that burn cleaner natural gas.

That reliance on natural gas has sometimes blinded agencies to local pollution and health impacts associated with the resource, said Rob Jackson, an earth scientist at Stanford and co-author of the study. In 2015, EPA said in a controversial draft study that hydraulic fracturing has not had "widespread, systemic impacts on drinking water resources in the United States" (Greenwire, June 4, 2015).

"The national office of EPA has tended to downplay concerns of their own investigators, in part because the Obama administration has promoted natural gas," Jackson said. "Natural gas is here to stay. It behooves us to make it as safe and environmentally friendly as possible."

EPA spokeswoman Julia Valentine said the agency hasn't yet finalized its assessment that natural gas has no "widespread, systemic impacts." As part of that process, the agency will evaluate all recent research, including DiGiulio's study, she said.

Encana Corp., the company that operated in the Pavillion basin, said repeated testing has shown people's water wells are safe for consumption.

"After numerous rounds of testing by both the state of Wyoming and EPA, there is no evidence that the water quality in domestic wells in the Pavillion Field has changed as a result of oil and

gas operations; no oil and gas constituents were found to exceed drinking water standards in any samples taken," said Doug Hock, an Encana spokesman.

Labs can't see fracking chemicals

Water testing began in 2009 when the local EPA office responded to complaints from residents. EPA headquarters, and DiGiulio, got involved in January 2010.

"Conducting a groundwater investigation related to fracking is extremely complicated," DiGiulio said. "It is difficult because a lot of the compounds used for hydraulic fracturing are not commonly analyzed for in commercial labs."

These labs were originally set up for the Superfund program, under which EPA cleans up the most contaminated sites in the nation. They are great at detecting chemicals found at Superfund sites but not as good at detecting chemicals used in fracking, DiGiulio said.

"You have some of these very water-soluble exotic compounds in hydraulic fracturing, which were not amenable to routine lab-type analysis," he said.

One such chemical was methanol. The simplest alcohol, it can trigger permanent nerve damage and blindness in humans when consumed in sufficient quantities. It was used in fracking in Pavillion as workers pumped thousands of gallons of water and chemicals at high pressure into the wells they were drilling. About 10 percent of the mixture contained methanol, DiGiulio said.

So the presence of methanol in the Pavillion aquifer would indicate that fracking fluid may have contaminated it. But methanol degrades rapidly and is reduced within days to trace amounts. Commercial labs did not have the protocol to detect such small traces, so DiGiulio and his colleagues devised new procedures, using high-performance liquid chromatography, to detect it. They devised techniques for detecting other chemicals, as well.

By then, Pavillion was roiling in controversy as EPA and residents collided with industry. EPA had drilled two monitoring wells, MW01 and MW02, in 2011, and its testing had found benzene, diesel and other toxic chemicals. But these results were contested by oil and gas industry representatives, who criticized EPA's sampling techniques (EnergyWire, Oct. 12, 2012). They pointed to a technical disagreement between EPA and the U.S. Geological Survey on the best methods to cast doubt on EPA's overall findings.

EPA realized it needed a consensus on its water testing methodology. In February 2012, it assembled a technical team from the USGS, Wyoming state regulators and tribal representatives from the Wind River Indian Reservation. They retested the monitoring wells in April 2012.

This time, they also tested for methanol. But EPA never released those results to the public. In 2013, the agency backed out of its investigation in Pavillion, handing it over to state regulators, who moved forward using a $1.5 million grant from Encana (EnergyWire, June 21, 2013). DiGiulio said the decision had come from EPA's senior management.

Methanol, diesel and salt

Industry representatives repeatedly pointed out that EPA had not published a peer-reviewed study on its findings.

"If the EPA had any confidence in its draft report, which has been intensely criticized by state regulators and other federal agencies, it would proceed with the peer review process," Steve Everley, a spokesman for Energy in Depth, an industry group, said at the time. "But it's not, which says pretty clearly that the agency is finally acknowledging the severity of those flaws and leaning once again on the expertise of state regulators."

In December 2015, state regulators published a draft of their findings. It stated that fracking had not contributed to pollution in Pavillion, according to the Casper Star Tribune. The report said the groundwater is generally suitable for people to use.

When DiGiulio retired from EPA in 2014, he trained his sights on Pavillion. He felt he had to finish his work.

"EPA had basically handed the case over and a peer-reviewed document was never finalized," he said. "If it is not in the peer-reviewed literature, then it presents a problem with credibility in terms of findings. It is important that the work be seen by other scientists and enter the peer review realm so that other scientists will have access to virtually everything."

Since 2012, a trove of new data had accumulated from USGS, EPA and state regulators. He obtained EPA's methanol testing results through a Freedom of Information Act request and downloaded the rest of the information from the Wyoming oil and gas regulator's website. All of it was publicly available, waiting for the right person to spend a year crunching the information.

The end result: a peer-reviewed study that reaffirms EPA's findings that there was something suspicious going on in Pavillion. More research is needed.

The sampling wells contained methanol. They also contained high levels of diesel compounds, suggesting they may have been contaminated by open pits where operators had stored chemicals, DiGiulio said.

The deep groundwater in the region contained high levels of salt and anomalous ions that are found in fracking fluid, DiGiulio said. The chemical composition suggests that fracking fluids may have migrated directly into the aquifer through fractures, he said.

Encana had drilled shallow wells at Pavillion, at depths of less than 2,000 feet and within reach of the aquifer zone, said Jackson of Stanford University.

"The shallow hydraulic fracturing is a potential problem because you don't need a problem with well integrity to have chemicals migrate into drinking water," he said.

The study also shows that there is a strong upward flow of groundwater in the basin, which means contamination that is deep underground could migrate closer to the surface over time.

"Right now, we are saying the data suggests impacts, which is a different statement than a definitive impact," DiGiulio said. "We are saying the dots need to be connected here, monitoring wells need to be installed."
Shallow wells are prevalent

EPA came to the same conclusion in a blistering response last week to Wyoming's draft findings.

"Many of our recommendations suggest that important information gaps be filled to better support conclusions drawn in the report, and that uncertainties and data gaps be discussed in the report," said Valentine, the EPA spokeswoman.

The state had tested people's water wells and detected 19 concerning chemicals. But regulators had concluded that only two chemicals exceeded safe limits and the water could be used for domestic purposes. EPA disagreed. Nearly half the 19 chemicals are unstudied, and scientists do not know the safe level of exposure, EPA stated.

Keith Guille, spokesman for Wyoming's Department of Environmental Quality, declined to comment on DiGiulio's study and on EPA's response to the state's draft report. The state is finalizing its findings and has its eyes set on the future, he said.

"We are not done yet," Guille said.

Energy in Depth, the industry group that had earlier criticized EPA for not publishing a peer-reviewed study, said that DiGiulio's study is "a rehash of EPA's old, discredited data by the very researcher who wrote EPA's original report."

Jackson stressed that the contamination seen at Pavillion could occur in other states where, according to a study published last year in Environmental Science & Technology on which he was the lead author, fracking sometimes occurs at shallow depths. That includes the Rocky Mountain region, New Mexico, Colorado, Utah, Montana and California. At present, no state has restrictions on how shallowly a company can frack, he said.

"Shallow hydraulic fracturing is surprisingly common, especially in the western U.S.," Jackson said. "Here in California, half of the wells are fracked shallower than about 2,000 feet."

Given the threat, fracking deserves much greater scrutiny than it has so far received from the Obama administration, said Hugh MacMillan, a scientist with the environmental group Food and Water Watch.

"Communities have never argued that every well goes bad; they've argued that when you drill and [are] fracking thousands, too many go bad," he said. "For those living on groundwater, it becomes a matter of luck, and that's not right, because over years, more and more people's luck runs out."

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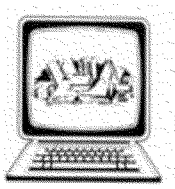

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